Having thus described the preferred embodiment, the invention is now claimed to be:

1. A method for determining a mass flux of an entrained phase in a planar two-phase flow, the method comprising the steps:

recording images of particles in the two-phase flow;

determining respective sizes of the particles as a function of a separation between spots identified on the particle images;

determining respective velocities of the particles; and

determining the mass flux of the entrained phase as a function of the size and velocity of the particles.

2. The method for determining a mass flux of a particle as set forth in claim 1, wherein the recording step includes:

recording an image of a transparent particle.

3. The method for determining a mass flux of a particle as set forth in claim 1, further including:

identifying glare spots on the particle, the particle size being determined as a function of a separation between the glare spots.

4. The method for determining a mass flux of a particle as set forth in claim 1, wherein the step of determining the velocity includes:

determining the velocity as a function of a velocimetry of the particles within the images.

5. The method for determining a mass flux of a particle as set forth in claim 4, wherein the step of determining the velocity as a function of the velocimetry includes:

obtaining two exposures of the respective glare spots of the particles entrained in the fluid; and

measuring a displacement between the two exposures during a specified time interval.

6. The method for determining a mass flux of a particle as set forth in claim 4, wherein the step of determining the velocity as a function of the velocimetry includes:

detecting a Doppler shift of light.

7. An optical flow meter for determining a mass flux of a particle, comprising:

a camera for recording an image of the particle entrained in a two-phase flow; and

a processor for determining a size of the particle as a function of a separation between spots identified on the particle, determining a velocity of the particle, and determining the mass flux of the particle as a function of the size and velocity.

8. The optical flow meter for determining a mass flux of a particle as set forth in claim 7, wherein the spots are glare spots.

9. The optical flow meter for determining a mass flux of a particle as set forth in claim 8, wherein the separation between the glare spots is determined as:

$$x_o = -aM\cos\frac{\theta_o}{2};$$

$$x_1 = n\,a\,M\sin\frac{\theta_o}{2}\left[n^2 + 1 - 2n\cos\frac{\theta_o}{2}\right]^{\frac{1}{2}}; \text{and}$$

$$d_p = \frac{2\Delta\varepsilon_p}{\left|-M\cos\frac{\theta_0}{2}\right| + \left|\frac{nM\sin\frac{\theta_0}{2}}{\sqrt{n^2+1-2n\cos\frac{\theta_0}{2}}}\right|},$$

where d_p is an estimate of the particle diameter, n is a ratio of an index of refraction of a material of the particle to an index of refraction of a medium, a is a radius of the particle, M is an optical system magnification, , Δ is a number of pixels separating the glare spots on a surface of a CCD, ε_p is a size of the pixels in the CCD, and θ_O is an observation angle.

10. The optical flow meter for determining a mass flux of a particle as set forth in claim 8, wherein a Gaussian peak location estimate is used for determining a location of respective peaks of the glare spots, the separation between the glare spots being determined as a function of the locations of the peaks.

11. The optical flow meter for determining a mass flux of a particle as set forth in claim 7, wherein the camera is a CCD camera.

12. The optical flow meter for determining a mass flux of a particle as set forth in claim 7, wherein the particles are transparent.

13. A method for determining a size of a particle, the method comprising:

receiving an image of the particle entrained in a two-phase flow into a processor;

reducing background noise within the image;

grouping the pixels having non-zero values into respective particle image arrays;

identifying glare spots within the image as a function of the particle image arrays; and

determining the size of the particle as a function of a separation between the glare spots.

14. The method for determining a size and a velocity of a particle as set forth in claim 13, wherein the reducing step includes:

limiting non-zero intensity values of pixels within the image.

15. The method for determining a size and a velocity of a particle as set forth in claim 14, wherein the limiting step includes:

determining a global threshold intensity value for the pixels within the image; and

setting intensity values of pixels below the global threshold to zero.

16. The method for determining a size and a velocity of a particle as set forth in claim 15, further including:

determining a local threshold for discriminating the particle within the image.

17. The method for determining a size and a velocity of a particle as set forth in claim 13, wherein the grouping step includes:

scanning the image for the pixels having the non-zero values;

identifying one of the pixels as having the non-zero value;

identifying pixels adjacent to the pixel having the non-zero value;

grouping any of the adjacent pixels having the non-zero values into the particle image array;

identifying subsequent pixels adjacent to each of the adjacent pixels having the non-zero value; and

grouping any of the subsequent pixels into the particle image array.

18. The method for determining a size and a velocity of a particle as set forth in claim 13, further including:

rejecting ones of the particle image arrays that are saturated.